Mapping language to the world:

The role of iconicity in the sign language input

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Research Highlights

- Child-directed signing exploits iconicity, especially when referents are not present (non-ostensive contexts).
- Child-directed signing uses pointing and iconicity in a complementary fashion.
- Results are consistent with findings that iconicity can support referential mapping: if iconicity is present in the input, it is available for use by the child.
- Iconicity may be an important strategy supporting referential mapping, qualitatively different from other strategies in language learning and hitherto underexplored in its potential.

Abstract

Most research on the mechanisms underlying referential mapping has assumed that learning occurs in ostensive contexts, where label and referent co-occur, and that form and meaning are linked by arbitrary convention alone. In the present study, we focus on *iconicity* in language, i.e. resemblance relationships between form and meaning, and on *non-ostensive contexts*, where label and referent do not co-occur. We approach the question of language learning from the perspective of the language input. Specifically, we look at child-directed language (CDL) in British Sign Language (BSL), a language rich in iconicity due to the affordances of the visual modality. We ask whether child-directed signing exploits iconicity in the language by highlighting the similarity mapping between form and referent. We find that CDL modifications occur more often with iconic signs than with non-iconic signs. Crucially, for iconic signs, modifications are more frequent in non-ostensive contexts than in ostensive contexts. Furthermore, we find that pointing dominates in ostensive contexts, and suggest that caregivers adjust the semiotic resources recruited in CDL to context. These findings offer first evidence for a role of iconicity in the language input and suggest that iconicity may be involved in referential mapping and language learning, particularly in non-ostensive contexts.

Introduction

Understanding language development remains one of the outstanding challenges of research in the language sciences. The process of referential mapping – making correct associations between form and meaning – is a complex task, yet children learn form-meaning mappings prodigiously. An extensive body of research has been dedicated to understanding how they do so. Some proposals focus on child-internal mechanisms, e.g. innate biases (such as the whole object bias; mutual exclusivity bias) that guide learning (Markman & Wachtel, 1988; Waxman & Booth, 2001) and powerful capacities for statistically-driven cross-situational learning (Frank, Goodman & Tenenbaum, 2009; Smith & Yu, 2008). Other proposals emphasise features of the communicative context, notably the role of joint attention in establishing common ground and understanding communicative intentionality (Tomasello, 1999; Tomasello & Carpenter, 2007). Child-directed language (CDL) – characteristic modifications to language production when communicating with children and used across languages, cultures, and language modalities – has furthermore been argued to support referential mapping by engaging attention and facilitating word segmentation (for spoken language, Fernald et al., 1989; Thiessen et al., 2005; for signed language, Masataka, 1992; Pizer, Meier & Points, 2011). Finally, the coordination of object naming with object individuation has important effects: providing a label while pointing to a referent has been shown to be correlated with children's vocabulary (Iverson et al., 1999; O'Neill et al., 2005); providing a label while the child is holding and visually isolating a referent has also been shown to facilitate referential mapping (Yu & Smith, 2012).

Despite their diversity, these proposals share two critical assumptions about the nature of the vocabulary-learning task. The first of these is that label and referent are linked by arbitrary convention alone, reflecting the long-standing tenet of arbitrariness as a fundamental design feature of language (Saussure, 1916; Greenberg, 1957; Hockett, 1960). The second is the assumption that learning occurs in ostensive contexts, where the co-occurrence of label and referent is essential to association mechanisms that link form and meaning through temporal binding (Glenberg & Gallese, 2012).

In this paper, we explore an alternative proposal: First, we assume that language (both spoken and signed) is also fundamentally iconic, i.e. showing resemblance relationships between form and meaning, as exhibited to varying degrees in the lexicon, as well as in co-speech gesture and in prosody, in addition to arbitrary (see Dingemanse, Blasi, Lupyan, Christiansen & Monaghan, 2015; Lockwood & Dingemanse, 2015; McNeill, 1992; Perniss, Thompson & Vigliocco, 2010; Perniss & Vigliocco, 2014 for overviews; see Liddell 2003; Taub 2001 for elaboration of the centrality of iconicity in signed language). Thus, we propose that iconicity in the language input may provide a powerful cue to referentiality, allowing the child to identify a referent from aspects of the communicative form itself (e.g. in using an onomatopoeic word such as *choo-choo* to refer to a train, the link between label and referent is more direct and transparent).

Second, we extend questions concerning language learning to non-ostensive contexts, where label and referent do not co-occur in the immediate environment (Jaswal & Markman, 2003; Tomasello & Barton, 1994). Parents often engage with their children in talk about the not immediately here-and-now (e.g. the trip to the park yesterday), and such contexts provide important opportunities for learning of words, especially referring to actions, events, and properties.

A growing body of recent research suggests that iconicity plays a role in language development. Language learners at different ages, and as young as 4 months old, have been shown to be sensitive to sound-symbolic associations (Asano et al., 2015; Ozturk et al., 2013; Maurer et al., 2006; Yoshida, 2012) and these iconic mappings have been argued to bootstrap children's word acquisition (Imai et al., 2008; Imai & Kita, 2014; Kantartzis et al., 2011; Monaghan et al., 2014; Perry, Perlman & Lupyan, 2015). Further evidence that iconicity has a role in language learning comes from findings that children's early vocabularies exhibit a preponderance of iconic forms. For example, studies looking at lexical development in German have found that onomatopoeic words make up a substantial proportion (up to 40%, Laing, 2014) of early verbal output, and then decrease as the use of more conventional word categories becomes dominant (Kauschke & Hofmeister, 2002; Laing, 2014). For signed language, Thompson et al. (2012) found that iconicity predicts both sign production and comprehension in deaf children aged 11-30 months learning BSL, after other variables (e.g. phonological complexity of the signs) are taken into account (contra earlier studies, e.g. Orlansky & Bonvillian, 1984, which did not find learning effects for iconic signs, but which were less well-controlled for these variables, see Thompson et al., 2012 for discussion).

For iconicity to be used by the child, it has to be present in the input. Indeed, there is some evidence that caregivers make increased use of iconic forms in child-directed language (CDL). This has been found for Japanese, a language with a rich inventory of sound-symbolic forms (Fernald & Morikawa, 1993; Toda, Fogel & Kawai 1990; Yoshida, 2012). In addition, there is some evidence that caregivers' use of CDL features – exaggerated intonation, slower articulation – is particularly salient for onomatopoeic words compared to non-onomatopoeic words (Laing, Vihman & Keren-Portnoy, 2016; Sundberg & Klintfors, 2009) and that CDL modifications correlate with and are used by caregivers to highlight properties of meaning (e.g. in domains indicating size, strength and valence; Herold, Nygaard & Namy 2011; Nygaard, Herold & Namy, 2009).

Present study

Here we investigate iconicity in the input in British Sign Language (BSL). Sign languages are notable for exhibiting a high proportion of iconicity in the lexicon, compared to the relative paucity of iconicity in spoken languages (Taub 2001). The visual nature of sign languages affords iconic depiction of a wide range of information that is visually perceived or motorically experienced (e.g. what things look like, how they are used, where they are, how they are moving). Estimates range between one-third and one-half of signs in the lexicon of different sign languages exhibiting some degree of iconicity (e.g. Boyes Braem 1986; Zeshan 2000). Moreover, iconic signs predominate in reference to objects and actions (very common in child directed language). Caregivers, therefore, have plenty of opportunities to further increase the salience of iconically-mapped features, thereby maximising the imagistic link with referents. More specifically, we suggest that caregivers may bootstrap referential mapping by modifying iconic signs to make the iconic properties more salient (similar to increased CDL modifications in onomatopoeia in spoken language, Laing et al.

2016). We further suggest that the role of iconicity may be particularly important in non-ostensive contexts, where form-meaning resemblance may help identify a referent from language even when the referent cannot be directly attended to. Whereas in ostensive contexts, pointing to the object can support referential mapping, in non-ostensive contexts, exaggeration of iconic features of signs may help bring the corresponding properties of referents to the mind's eye. Thus, in asking whether iconicity is prominent in BSL language input, we are not looking for the presence of iconicity per se. Rather, we look at whether and under what conditions caregivers modify sign productions in child-directed language to increase the salience of those conceptual properties that are imagistically evoked by iconic signs.

We focus on modifications typical of child-directed signing (Pizer & Meier, 2008; Reilly & Bellugi, 1996; see *Coding* section for details). CDL modification is one of the strategies used by caregivers to scaffold the development of sign-to-world mappings. Here we predict that CDL modifications will be particularly prevalent in iconic signs (e.g. the BSL sign DRIVE in Figure 2A) compared to non-iconic signs (e.g. the BSL sign for PLAY in Figure 2B). Crucially, in iconic signs, the increased salience provided by CDL modification typically emphasises the iconic aspect of signs (e.g. the shape and movement of the steering wheel in the sign DRIVE), thereby specifically highlighting the element that describes the similarity between the form and referent. In addition, we predict that CDL modifications highlighting iconic mappings may feature particularly in caregivers' language when referents being talked about are absent (non-ostensive contexts) compared to when referents are present (ostensive contexts) because of the potential for iconicity to render conceptual properties of referents readily available. In addition, we look at the use of pointing as a strategy for singling out a referent. We expect pointing to occur more in ostensive contexts (when referents are present, and the co-occurrence of point and referent can scaffold referential mapping) compared to non-ostensive contexts (when referents are absent; see *Coding* section on the availability of pointing in non-ostensive contexts).

Method

Participants

Ten participants were recruited from the greater London area (8 female). All participants were deaf, fluent signers of BSL, and used BSL as the primary language of communication with their deaf (three participants) or hearing (seven participants) children. The average age of participants' children was 3;2 years (38 months), ranging from 2;1 years (25 months) to 4;3 years (51 months).

Materials

The materials used in the task consisted of four toy sets: (1) farm animals; (2) cooking set; (3) doctor's kit; and (4) tool bench (see Figure 1). Toy set selection was based on the presence of multiple individual parts that encouraged manipulation and narrative construction (e.g. visit to the doctor) and that had clear labels (e.g. different animals) exhibiting perceptuo-motor properties (e.g. handling affordances of tools). The toy sets were age appropriate and novel to participants.

Figure 1. Toy sets used in the task: (a) Farm animals, (b) Cooking, (c) Doctor's kit, and (d) Tool bench.

Procedure

Participants were asked to imagine playing with their child in two conditions, without the child being present. This methodology avoids issues of feedback and interaction that are difficult to control, while still maintaining ecological validity. Our decision to employ a methodology where participants imagined playing with their child was further motivated by the desire to obtain data that was not affected by local adaptation to a present addressee (Brennan, Galati & Kuhlen 2010). Similar methodology has been successfully employed in studies on co-speech gesture use, where participants were asked to imagine talking to different kinds of addressees (Bavelas, Coates & Johnson 2002; Campisi & Özyürek 2013). Nygaard et al. (2009) offer evidence that CDL modification of speech is reliable in contexts without a real-life addressee: participants instructed to employ CDL in a sentence production task showed remarkable overlap in their use of intonation. In addition, Sachs & Devin (1976) found that children used CDL when talking to a baby, but not an adult, and found no difference in speech between talking to a real baby vs. a baby doll. In the *Ostensive* condition, caregivers used and interacted with the toy sets during the session. In the *Non-ostensive* condition, caregivers imagined playing with and talking about the toys with their child. Caregiver strategy for addressing the imagined interlocutor was the same between conditions, but varied between participants: some treated the camera location as the location of their child; others chose a proximal location (e.g. next to them) as the imagined location of their child. The order of conditions in each session was counter-balanced across participants, as was the order of toy sets in each condition. Participants were familiarised with each toy set before the session started. Data was collected through video-recording of sessions by two deaf, fluent users of BSL (one of whom is an author, JL) in participants' homes. The purpose of the study was explained to participants after recording had taken place.

Coding

The video data from each session was cut into individual clips corresponding to each toy set in each condition, such that eight video clips (4 toy sets; ostensive vs. non-ostensive) were associated with each participant. Average clip duration was 2;02 minutes (range: 0;49 minutes to 3;33 minutes) in the *Ostensive* condition and 1;24 minutes (range: 0;24 minutes to 2;46 minutes) in the *Non-ostensive* condition (the difference in length was not significant, t-test p=0.12).

Each clip was transcribed and coded on a sign-by-sign basis using ELAN (Wittenburg, Brugman, Russel, Klassmann & Sloetjes, 2006) by a deaf BSL signer (by one of the authors, JL); subsequent reliability coding for CDL modification was carried out by two other deaf BSL signers. All data was in BSL (reflecting the participants' use of BSL as the primary language of communication with their children, whether deaf or hearing). As detailed below, we coded (core) lexical signs for CDL modification and iconicity. We coded only signs that referred directly to the toy sets – the objects themselves, their features/attributes, actions performed with them, or events related to them. We excluded first and second person pronominal forms (personal and possessive) and signs that contributed primarily to discourse cohesion (e.g. 'right', 'what', 'can', 'have'). We also excluded classifier constructions (non-core lexicon; Brentari & Padden 2001), number signs (e.g. 'two'), and mental verbs (e.g. 'think'), which exhibit structurally more complex or abstract iconicity (Meir 2010; Taub 2001). Pointing signs to referents (non-core lexicon) were coded separately.

Iconicity: To answer our main question about the use of iconicity in CDL, signs were coded categorically as being iconic (e.g. 'hammer') or non-iconic (e.g. 'play'). In total, 506 different signs types were coded for iconicity (see the Appendix for the full list). Reliability of our iconic/non-iconic sign categorisation was compared with iconicity ratings independently obtained for two sets of BSL signs (a set of 300 signs, Vinson et al. 2008; a set of 475 signs, Marshall, Beese & Atkinson, unpublished). For both sets, signers were asked to rate the iconicity of each sign (i.e. the extent to which the sign looks like what it means) on a scale of 1-7 (1=not at all iconic; 7=highly iconic). Iconicity ratings exist for 142 signs in our data set, corresponding to 28% of our total sign types.

Signs that received a mean rating score above 3.5 were considered to be iconic (Ortega & Morgan 2015). In total, our coding agreed with iconicity ratings for 134 out of 142 sign types (94%). We excluded from our analysis the 8 sign types for which coding and rating (in at least one set) disagreed. This resulted in the exclusion of a total of 13 sign tokens in the *Ostensive* condition, and 16 sign tokens in the *Non-ostensive* condition. (See the Appendix for a full list of signs, iconicity coding, and consistency between coding and ratings.)

CDL modification: All signs that were coded for iconicity were coded for CDL modification. We focused on three types of manual modification that have been identified as characteristic of child-directed signing in previous studies: *enlargement*, *lengthening,* and *repetition* (Pizer, Meier & Points, 2011; Holzrichter & Meier, 2000). Signs are *enlarged* when they exhibit increased movement excursion; *lengthening* is present when sign duration is increased by slower production or by holding a sign in place for longer compared to the citation form; *repetition* is defined in terms of movement iterations, or increased cyclicity, of the sign (see examples in Figure 2). Importantly, CDL modifications occurred for iconic (Figure 2A) and non-iconic (Figure 2B) signs. Modification of signs, as characteristic of CDL, was judged by the coders based on their knowledge of and intuition about BSL use (Figure 2 shows examples of the same signs in modified and non-modified versions from our data). Twenty percent (20%) of the data, corresponding to 16 video clips (8 ostensive; 8 non-ostensive), was independently coded for CDL modifications of signs. The proportion of inter-coder agreement was 93%. For the signs for which there was disagreement, coding was discussed between the coders until full agreement was reached.

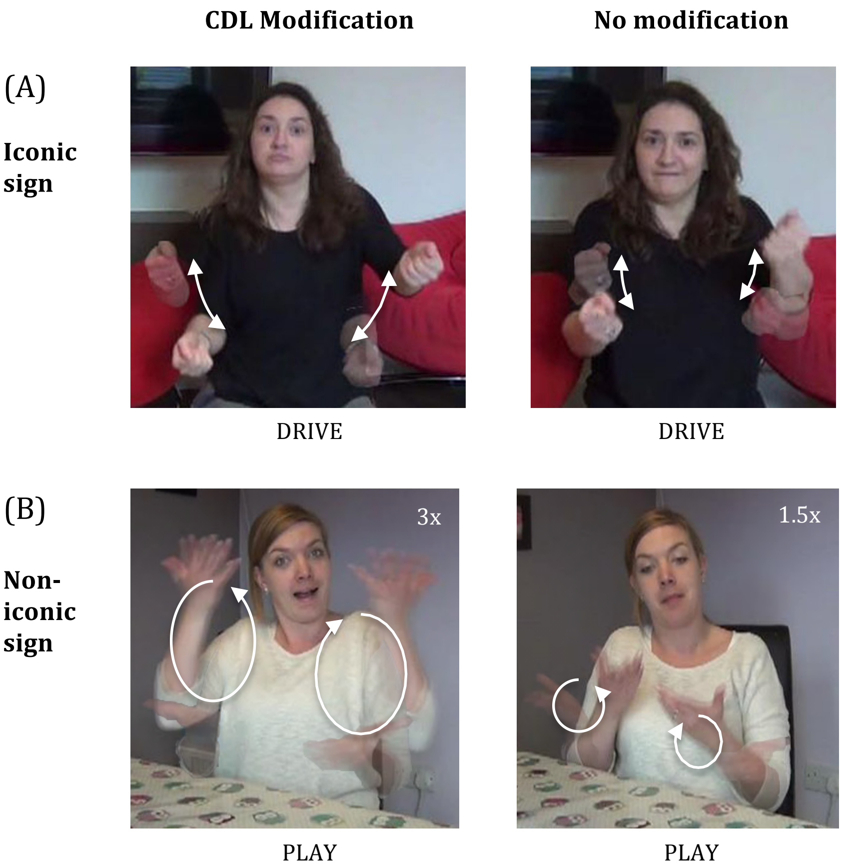


Figure 2. Examples of BSL signs from the data corpus. (A) The iconic sign DRIVE with CDL modification (left panel) and no modification (right panel). In the modified form, the movement of the sign is notably *enlarged* in the modified version compared to the non-modified version; in addition, the modified sign is *lengthened*, produced in a more protracted manner compared to the non-modified version (not visible in the still). (B) The non-iconic sign PLAY with CDL modification (left panel) and no modification (right panel). In the modified form, the movement is *enlarged* compared to the non-modified version of the sign; in addition, the modified sign exhibits *repetition*, produced with more iterations of the movement compared to the non-modified form.

Pointing: In sign language, points can be to actual referents or to the conceptual locations of referents (Klima & Bellugi 1979; Liddell, 2003). Thus, pointing signs occurred in both the *Ostensive* (see Figure 3a) and the *Non-ostensive* conditions (see Figure 3b). As we were interested in pointing as a separate strategy for singling out referents, we did not code for CDL modifications of pointing signs (though such modification is technically possible).

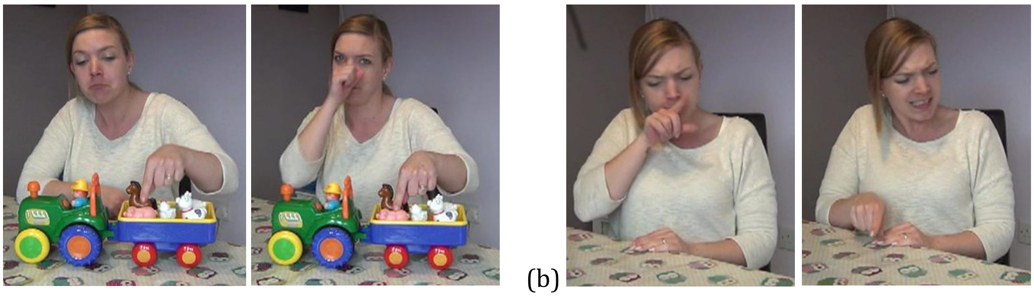
(a) (b)


Figure 3. Examples of pointing: (a) *Ostensive*: the signer points to the toy pig in the tractor (first still), and then produces the sign PIG while continuing to point to the pig (second still); (b) *Non-ostensive:* the signer produces the sign CHICKEN (first still), and then associates the chicken with a location in the sign space by means of a pointing sign.

Phonological complexity: All signs that were coded for iconicity were also coded for phonological complexity (following the procedure used by Mann, Marshall, Mason & Morgan, 2010; Vinson, Thompson, Skinner & Vigliocco, 2015). First, individual parameters are assigned a complexity value: *Handshape:* 0 (unmarked handshape; see Sutton-Spence & Woll 1999), +1 (all other handshapes), +1 (handshape change). *Movement:* 0 (one movement, internal or path), +1 (both internal and path movement, or more than one path movement). *Location*: 0 (neutral space), +1 (all other locations), +1 (location change). *Hands*: 0 (one-handed), +1 (two-handed), +1 (two different handshapes). These values are then added together to obtain an overall measure of phonological complexity.

Results

CDL modification in iconic vs. non-iconic signs across contexts

We performed a 2×2 ANOVA (iconicity: iconic vs. non-iconic × condition: ostensive vs. non-ostensive) to test whether caregivers exploit iconicity in CDL modifications and whether they do so particularly in non-ostensive contexts (see Figure 4). The denominator for this analysis comprises all signs that were coded for iconicity and CDL modification.

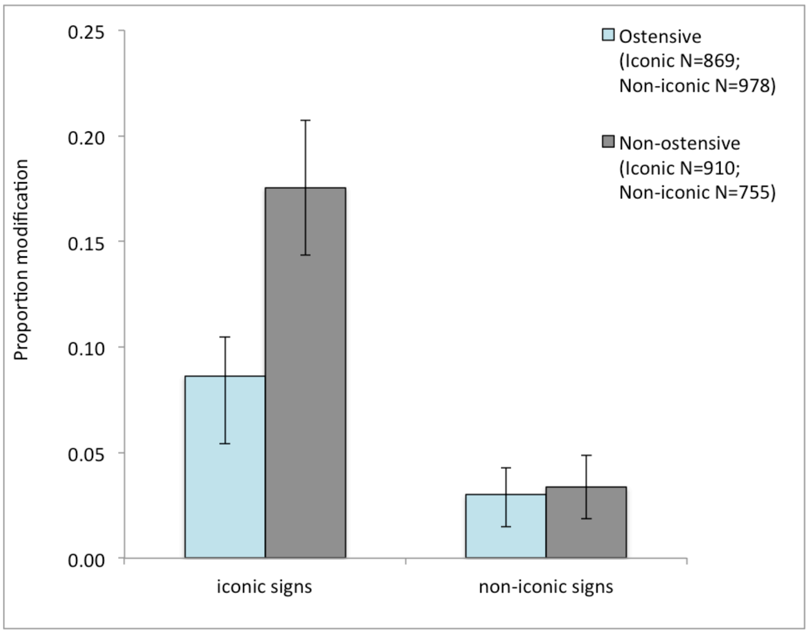


Figure 4. Proportion of CDL modification in iconic vs. non-iconic signs in *Ostensive* and *Non-ostensive* conditions. Error bars reflect standard error of the mean (by participants).

We found a main effect of iconicity ($F(1,9) = 38.463$, $p < .001$, $\eta^2_{partial} = .810$). We see overall more CDL modification with iconic signs compared to non-iconic signs. We found a main effect of context ($F(1,9) = 14.967$, $p < .01$, $\eta^2_{partial} = .624$); there is overall more CDL modification in *Ostensive* compared to *Non-ostensive* contexts. We also found a significant interaction between iconicity and toy condition ($F(1,9) = 18.112$, $p < .01$, $\eta^2_{partial} = .668$). Crucially, we see significantly more CDL modification for iconic signs in the *Non-ostensive* compared to the *Ostensive* condition, but no difference between conditions for non-iconic signs.[1]

This analysis shows that there is a greater degree of modification for iconic than non-iconic signs and especially in the non-ostensive condition. However, these effects could be due to item-specific properties. It is the case, in fact, that iconic signs in our dataset tend to be more phonologically complex than

[1] These patterns are robust across participants. All caregivers display a greater degree of CDL modification for iconic signs compared to non-iconic signs in both conditions. For iconic signs, all but one parent displayed more modification in the non-ostensive compared to the ostensive condition.

non-iconic signs (U = 25023.500, z = -2.975, p < .01). In order to assess further the role of item-specific characteristics, we carried out a follow-up analysis comparing modifications of sign-tokens for the same sign-type occurring in both ostensive and non-ostensive conditions. For iconic signs (53 sign types) modifications were more common in the non-ostensive than in the ostensive condition (ostensive N=390; non-ostensive, N=435, z = -3.180, p = .001). No difference was found for non-iconic signs (21 sign types: ostensive, N=271; non-ostensive, N=247, z = -.729, p = .481). Thus, the greater degree of modification we observed in the non-ostensive condition for the iconic signs does not depend on item-specific characteristics.

Finally, one may ask whether the same effects are found across semantic categories. In a final analysis, we categorised iconic and non-iconic signs according to semantic criteria. This allowed us to assess whether caregivers' more prevalent use of CDL modifications with iconic signs was general across semantic categories. We divided the signs into three categories: the Object category (106 sign types) included signs that referred to objects in our toy sets (e.g. 'hammer'); we excluded signs that referred to places (e.g. 'garden'), bodyparts (e.g. 'nose', as these are primarily deictic points), persons (e.g. 'doctor'), and mass quantities (e.g. 'water'). The Action category (121 sign types) included signs referring to concrete or observable actions/events (e.g. 'drink', 'search'); we excluded other types of verb signs (e.g. 'start', 'pretend'). Signs in the Property category (78 sign types) described properties of objects (e.g. 'green'), actions (e.g. 'fast'), or people (e.g. 'ill'); signs that expressed positive or negative value (e.g. 'good', 'bad') were not counted. (See Appendix for categorisation of signs.) We performed a 2×2×3 ANOVA to test CDL modification of signs across conditions and semantic category of signs (iconicity: iconic vs. non-iconic × condition: ostensive vs. non-ostensive × category: object vs. action vs. property) (Figure 5).

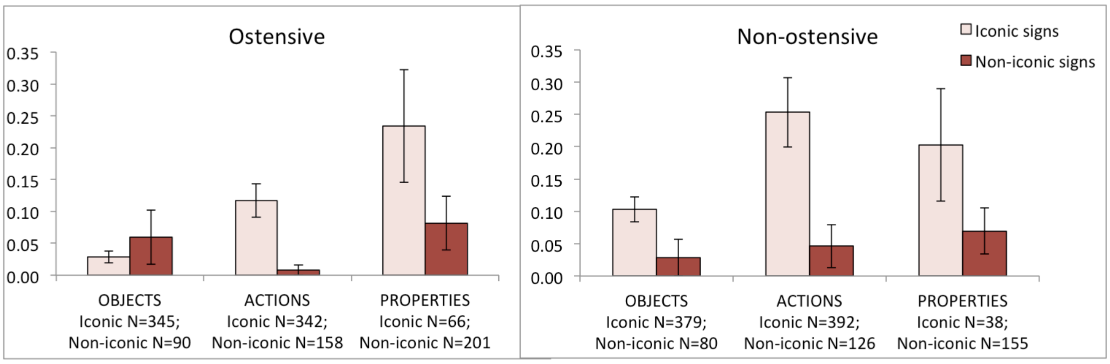


Figure 5. Proportion of CDL modification in iconic vs. non-iconic signs in *Ostensive* contexts (left) and *Non-ostensive* contexts (right) for signs referring to Objects, Actions, and Properties. Error bars reflect standard error of the mean (by participants).

We found a main effect of iconicity ($F(1,9) = 34.954$, $p < .001$, $\eta^2_{partial} = .795$). Iconic signs are modified significantly more often than non-iconic signs. There were no other main effects (condition: $F(1,9) = 1.960$, $p = .195$, $\eta^2_{partial} = .179$; category: $F(2,18) = 2.459$, $p = .114$, $\eta^2_{partial} = .215$). There was an interaction between condition and iconicity ($F(1,9) = 26.244$, $p < .01$, $\eta^2_{partial} = .745$) indicating that iconic signs are modified more in *Non-ostensive* compared to *Ostensive* conditions. We also found a significant interaction between iconicity and category ($F(2,18) = 3.879$, $p < .05$, $\eta^2_{partial} = .301$). CDL modifications were significantly more likely for iconic than non-iconic signs for both Action (iconic: $M = .20$, $SD = .1251$, non-iconic: $M = .03$, $SD = .0553$, $t(9) = 5.088$, $p <.01$) and Property (iconic: $M = .24$, $SD = .2630$, non-iconic: $M = .08$, $SD = .1168$, $t(9) = 2.705$, $p < .05$) signs, but not for Object (iconic: $M = .07$, $SD = .0386$, non-iconic: $M = .04$, $SD = .0851$, $t(9) = 1.172$, $p = .271$) signs. The interaction between condition and category ($F(2,18) = 2.028$, $p = .161$, $\eta^2_{partial} = .184$), and the three way interaction were non significant ($F(2,18) =.995$, $p = .389$, $\eta^2_{partial} = .001$.

Pointing across contexts

We calculated the proportion of pointing signs to referents or referent locations in the *Ostensive* condition vs. in the *Non-ostensive* condition (see Figure 6). The denominator for this analysis comprises all signs that were coded for iconicity/CDL modification and pointing signs.

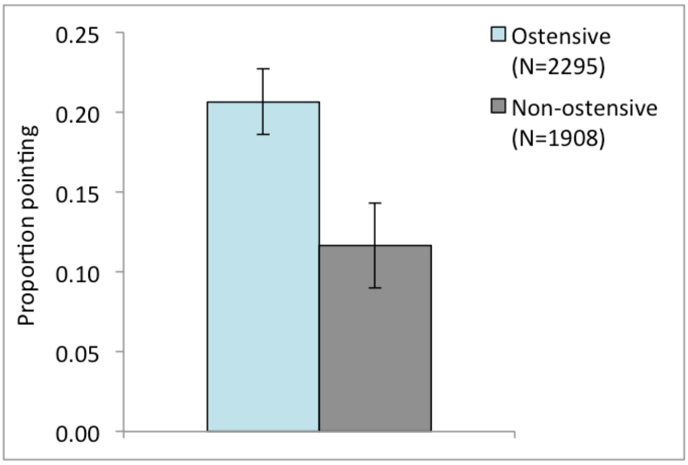


Figure 6. Proportion of pointing in *Ostensive* and *Non-ostensive* conditions. Error bars reflect standard error of the mean (by participants).

We performed a non-parametric Wilcoxon test for the mean proportion (by participant) of pointing in the *Ostensive* and *Non-ostensive* conditions. Results showed that points were significantly more likely in the *Ostensive* condition than in the *Non-ostensive* condition ($z = -2.244$, $p < .05$).

Discussion

Previous research has shown that learners of spoken languages are sensitive to sound-symbolic mappings (Imai & Kita, 2014) and that early vocabularies of both signed and spoken languages exhibit iconicity (Laing, 2014; Thompson et al., 2012). Here, we investigated the role of iconicity in language learning from the perspective of the language input: Do signing caregivers enhance iconicity in their input? If so, iconicity can be used to establish referent identity. We looked specifically at child-directed signing when objects being talked about were present (ostensive contexts) and when they were absent (non-ostensive contexts). These are two main types of context in which children face the task of mapping words to the world. We predicted that the iconicity already prevalent in the lexicon of a sign language may be enhanced in caregivers' child-directed language through modifications typical of CDL. For iconic signs, these modifications increase the salience of the (iconic) form-meaning mapping and may thereby contribute to bootstrapping learning of the meaning of signs. We further hypothesised that highlighting the iconic mapping in this way may be especially useful in non-ostensive contexts. When referents are not present, the cue to referent identity inherent in the iconic label may help to imagistically evoke the corresponding concept.

We first assessed the relationship between sign iconicity and the use of CDL modification. We found that CDL modifications were more likely to occur with iconic signs than non-iconic signs, and that for iconic signs (but not for non-iconic signs) modifications were more frequent in non-ostensive contexts than in ostensive contexts. We found the same effect when we looked at only those sign types that occurred in both ostensive and non-ostensive conditions and that were modified in at least one condition (thus ruling out item-specific confounds).

When we looked at the distribution of iconicity in the lexicon by category, we found that signs for objects and actions were predominantly iconic, while signs for properties were predominantly non-iconic. However, CDL modification of signs was significantly more common for iconic signs than for non-iconic signs for both properties and actions, while iconic and non-iconic signs were equally likely to be modified for objects. Finally, we looked at the use of referential pointing and found that pointing dominated in ostensive contexts. This was the case even though the morphosyntax of sign languages relies to a large extent on the use of pointing to conceptual locations of referents (Klima & Bellugi, 1979; Sandler & Lillo-Martin, 2006).

Thus, our results suggest that one function of caregivers' use of CDL modifications is to make features of referents reflected in iconic mappings more salient. For example, the modification of the sign DRIVE in Figure 2A highlights the distinctive features of the referent (i.e. the shape and movement of the steering wheel that is gripped in order to drive) on which the iconic mapping is based. While CDL modifications of iconic signs may of course be equally useful and effective for making features of referents more salient in ostensive contexts, here, because a direct visual comparison between sign and referent can be made, caregivers tend to favour pointing. Thus, our findings suggest that caregivers are sensitive to the context and adjust their CDL strategies accordingly in the service of supporting referential mapping. As such, child-directed language may serve not just to engage and keep attention (Fernald et al., 1989) or to facilitate segmentation (Thiessen et al., 2005), but to support referential mapping by bringing properties of referents to the mind's eye. Our methodology underscores this point, as we can rule out that modifications were being used to keep the child's attention. Our findings also complement recent findings by Novack, Goldin-Meadow, and Woodward (2015), showing that children learn about target actions better from demonstrations with iconic gestures compared to demonstrations with pointing gestures.

Our findings are striking in that they suggest a mechanism for language learning that may be particularly useful in non-ostensive contexts. The majority of research on language learning has studied referential mapping in ostensive contexts, consistent with the implicit assumption that co-occurrence underscores learning (Glenberg & Gallese 2012), at least in early years. It is plausible, however, that non-ostensive contexts constitute a large proportion (if not the majority) of learning episodes (Tomasello & Barton, 1994; Tomasello et al., 1996), and it is thus crucial to understand word-learning strategies in these contexts.

Displacement and communicative salience

Studies by Tomasello and colleagues have highlighted the role of shared communicative goals and socio-cognitive development in learning in non-ostensive contexts. Tomasello et al. (Tomasello & Kruger, 1992; Tomasello & Barton, 1994; Tomasello et al., 1996; see also Ambalu et al., 1997) investigated word learning in non-ostensive contexts that were defined in terms of timing: a sentence referring to an action/object was uttered either immediately before or after the child saw the action/object. They found that children learned labels as well as (for objects) or better (for actions) when label and referent did not temporally overlap. For example, when an adult produced a novel word in conjunction with expressing the intention to find an object, children were able to infer the identity of the correct target referent for the novel word based on the adult picking up first one object, and rejecting it, then picking up another object and looking satisfied with it (Tomasello & Barton, 1994). For verb meanings, learning was less successful when the action was ongoing during label production, suggesting that when a child's attention was focused on a novel action, the simultaneously uttered label was more likely to be disregarded (Tomasello & Kruger, 1992).

Little is known, however, about word learning in contexts in which referents being talked about are fully displaced from the here-and-now of the communicative context. Without denying an important role for attentional demands and the child's ability to infer intentionality, we argue that iconicity may offer a powerful and qualitatively different cue for learning in non-ostensive contexts because it can bring to mind properties of referents not in the here-and-now.

Our results have implications for our understanding of the mechanisms involved in the challenge of reducing referential ambiguity and thus of vocabulary acquisition. We have seen that caregivers use modifications characteristic of child-directed signing to make iconic properties more salient. As such, iconicity can play an important role in increasing communicative salience, just like pointing. We suggest that there may be a division of labour between iconicity and pointing as both make the link between form and referent more salient, but in different, complementary ways. Whereas pointing can focus a child's attention directly on the physical referent whose label is provided, properties of referents can be imagistically highlighted using iconic form-meaning mappings through modification of the phonological form of the sign (e.g. enlargement of the movement in the sign DRIVE, making the manner of holding the wheel to drive more salient). This can scaffold referential mapping even when the referent is not present in the immediate environment.

It is important to understand what kinds of cues are available in the input, as these are cues that the child may potentially learn from. There is already some evidence that iconicity facilitates learning (e.g. Thompson et al. 2012 for sign language; e.g. Imai et al. 2008, Imai & Kita 2014 for spoken language). However, knowing that iconic signs/words are learnt earlier does not entail that iconicity is available to the child in the language input. Here, we have demonstrated that iconic cues are in fact present in the input.

Iconicity in signed and spoken languages

Does the effect of iconicity we see in our study generalise across signed and spoken languages? All sign languages are likely to exhibit widespread iconicity in the lexicon, due to the affordances of the visual modality (Taub 2001). Much of what we talk about can be visually observed or motorically experienced – e.g. size and shape features; locations, spatial relationships, and motion patterns; actions with objects – and these kinds of meanings are typically represented in a (visually and motorically) iconic way in sign languages (Klima & Bellugi 1979; Liddell 2003; Taub 2001). In contrast, spoken languages vary greatly in the amount of iconicity exhibited in the lexicon. English and other Indo-European spoken languages tend to have quite limited inventories of iconic forms, and primarily of the onomatopoeic nature (e.g. *meow, bang*), which represent sound-to-sound mappings. However, a vast proportion of the world's spoken languages – e.g. East Asian, Southeast Asian, Australian, African, and South American languages – have large, rich inventories of iconic word forms (also called sound-symbolic forms, mimetics, ideophones, or expressives) (Hinton, Nichols & Ohala 1994; Voeltz & Kilian-Hatz 2001). In these languages, specific consonants and vowels are consistently associated with specific meanings related to information like size and shape, manner of motion, or aspectual/temporal (e.g. iterative, continuous, punctual) structure of events (as e.g. in Japanese *gorogoro* 'big object rotating', *korokoro* 'small object rotating', *chikachika* 'small lights flashing') (Vigliocco & Kita, 2005).

Communication in spoken languages, however, is not restricted to the encoding of linguistic, lexical units in speech. In face-to-face contexts, which are likely to characterise the majority of communicative interactions with children, the opportunity for iconicity proliferates. Co-speech gestures that accompany speech offer similar opportunities for iconic representation of action affordances and visual features of referents (McNeill 1992; Kendon 2004). For example, a co-speech gesture similar in form to the BSL sign in Figure 2a could accompany talking driving. In addition, the acoustic signal itself can be prosodically modulated to embed iconicity, as e.g. in the vowel lengthening in *looooong* to mean a very long time (Okrent 2002). Thus, considering the whole package of spoken language communication – including speech, co-speech gesture, and prosody – there may be ample opportunity for iconicity to be embedded in the language input, even in a language like English that has relatively little iconicity in the lexicon. As such, the degree to which iconic mappings in different channels of expression are highlighted may vary depending on the level of iconicity in the lexicon.

The distribution of iconicity in the lexicon

The effects of language modality and typology on the presence of iconicity in the lexicon are also interesting to consider with respect to potential differences in the phonological modifiability of iconic and non-iconic forms. If iconic signs/words are more modifiable than non-iconic signs/words, this would support the articulatory salience of iconic and onomatopoeic forms in child-directed language (Kunnari, 2002; Laing, 2015) and would go some way in explaining the prevalence of iconic and onomatopoeic forms in children's early vocabularies (Laing, 2014; Thompson et al., 2012). Our analysis of phonological complexity showed that the iconic signs in our data set tended to be somewhat more phonologically complex than the non-iconic signs. This may be related to a need for greater specificity (and thus greater complexity) of handshape, location and movement to create structure-preserving (Taub 2001), iconic mappings between form and referent. This greater specificity may also contribute to increased modifiability.

Our results also suggest that sign iconicity varies across semantic categories. Notably, signs referring to objects and actions are more likely to be iconic, whereas signs referring to properties (e.g. substance, colour) are more likely to be non-iconic. The increased CDL modification for iconic signs compared to non-iconic signs in both the action and property categories, however, suggests that these modifications are not simply more typical for signs that are more likely to be iconic. The different patterns of modification across sign categories are interesting to consider: both Property and Action signs showed more modification for iconic signs in both conditions, while iconic Object signs were modified more than non-iconic signs only in the non-ostensive contexts. One possibility is that modification may be less important for objects that are physically present (i.e. the toys), compared to actions and properties related to those objects. In addition, the signs for many of the objects in our toy sets (e.g. the animals) are iconic, making modification in the ostensive contexts more important for the non-iconic object signs. Another possibility relates to how easy it is to modify a given phonological parameter. For Object signs, the iconic mapping may be more likely to be in the handshape and location (as in the BSL sign COW, which represents the cow's horns at the sides of the forehead, with a handshape in which the thumb and pinky are extended) than in the movement parameter. However, for Action signs (as in the sign PLAY) and Property signs (as in the sign BIG) iconicity would be carried more by the movement parameter. The movement parameter may just be easier to modify (as in repetition, enlargement and lengthening). Crucially, if modification of iconic signs bootstraps referential mapping, this differential pattern of results suggests different rates of acquisition in children. As such, our results are consistent with previous research that has shown that children learning a sign language acquire a greater proportion of predicates (than nominals) early on compared to children learning a spoken language (for whom the pattern is reversed) (Anderson & Reilly, 2002 for American Sign Language (ASL); Hoiting, 2006, for Sign Language of the Netherlands (NGT); Rinaldi et al. 2014 for Italian Sign Language (LIS).

Conclusion

This study offers initial evidence from sign language for a role of iconicity in the language input and suggests that iconicity may be exploited in referential mapping and language learning. The findings pave the way for similar research on spoken languages, where the potential for iconicity, and the ways in which it may be exploited in the language input, may differ in interesting ways, contributing to a more comprehensive understanding of the way in which iconicity may provide a mechanism involved in language learning. Importantly, iconicity may be qualitatively different from previously identified mechanisms involved in language learning in that iconicity is present – and manipulable in terms of its communicative salience – in the language form itself. Moreover, our study suggests that both indexicality (pointing) and iconicity may be significant semiotic resources that are exploited in child-directed language. The study of communicative context, in particular ostensive vs. non-ostensive contexts, represents an important and novel aspect of this study. Displaced reference is a fundamental and highly prevalent feature of language use and function, and an understanding of the potential for learning in non-ostensive contexts is crucial for a full understanding of language development. Finally, our findings are consistent with the idea that iconicity is fundamental to language in providing a way to link language to our experience with the world (Perniss & Vigliocco, 2014) and support the idea that to understand language, it must be studied in its core ecological niche, and thus in its contexts of use in face-to-face interaction.

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Appendix

The appendix lists all sign types (506 total) in our data set that were coded for sign category (Action, Object, Property) and iconicity (0 = non-iconic; 1 = iconic). The final column indicates whether iconicity ratings were consistent with our categorical coding (Agree or Disagree), using a cut-off of 3.5 (Ortega & Morgan 2015). If iconicity ratings were available for a sign from both sets of signs (Vinson et al. 2008; Marshall et al., unpublished), both decisions are given, separated by a forward slash. We excluded all signs for which our coding disagreed with at least one available iconicity rating. This resulted in the exclusion of a total of 8 sign types (indicated in bold). For signs that were excluded, the margin of disagreement between our coding and the rating is indicated in brackets. (The margin is 0.3 or less for 4 of the 8 excluded sign types.)

Number	Sign	Sign category (*n.c.*=not coded)	Iconicity coding	Iconicity rating available, agree/disagree with coding
1	ADD	Action	0	
2	ADULT	*n.c.*	0	
3	AFRAID	Property	0	Agree
4	AGE	*n.c.*	0	
5	AGREE	*n.c.*	0	Agree
6	ALL	*n.c.*	0	
7	ALLOWED	*n.c.*	0	Agree
8	ANIMAL	Object	0	Agree
9	AREA	*n.c.*	1	
10	ARM	*n.c.*	1	
11	ARRIVE	Action	0	Agree
12	AUTOMATIC	*n.c.*	0	
13	AWFUL	*n.c.*	0	
14	BABY	*n.c.*	1	
15	BAD	*n.c.*	0	
16	BAD-BREATH	*n.c.*	0	
17	BADGE	Object	1	Agree
18	BAG	Object	1	
19	BANDAGE	Action	1	
20	BEAUTIFUL	Property	0	Agree
21	BED	*n.c.*	0	**Disagree (margin: 0.30)**
22	BEDROOM	*n.c.*	0	
23	BELL	Object	1	
24	BENCH	Object	1	
25	BETTER	*n.c.*	0	
26	BIG	Property	1	
27	BIRD	Object	1	
28	BIRTH	*n.c.*	1	
29	BLACK	Property	0	Agree/Agree
30	BLOCKED	Property	0	
31	BLOOD	*n.c.*	1	
32	BLUE	Property	0	Agree
33	BODY	*n.c.*	1	
34	BOIL	Action	1	
35	BOTH	*n.c.*	1	
36	BOWL	Object	1	Agree
37	BOX	Object	1	Agree
38	BOY	*n.c.*	0	Agree/Agree
39	BRAVE (from chin)	Property	0	Agree
40	BREAD	*n.c.*	0	**Disagree (margin: 0.50)**
41	BREAK	Action	1	
42	BREAKDOWN	*n.c.*	0	
43	BREATHE	Action	1	Agree
44	BRING	Action	1	

45	BROTHER	*n.c.*	0	
46	BROWN	Property	0	Agree/Agree
47	BUILD	Action	1	
48	BURN	Action	1	
49	BUTTON	Object	1	
50	BUY	Action	0	Agree
51	CABINET	Object	1	
52	CALL	Action	1	
53	CALM	Property	0	
54	CALPOL (medicine)	*n.c.*	0	
55	CAN (tin)	Object	1	Agree
56	CAR	Object	1	
57	CAREFUL	*n.c.*	0	Agree
58	CARROT	Object	0	
59	CASTLE	Object	1	Agree
60	CHAINSAW	Object	1	
61	CHAIR	Object	1	Agree
62	CHANGE	Action	0	
63	CHECK	Action	0	
64	CHEEKS	*n.c.*	1	Agree
65	CHEW	Action	1	
66	CHICKEN (beak)	Object	1	
67	CHICKEN (wings)	Object	1	
68	CHILD	*n.c.*	1	
69	CHIMNEY	Object	1	
70	CHOP	Action	1	
71	CLEAN	Action	0	
72	CLEAR	Property	0	
73	CLEVER	Property	0	Agree
74	CLIP	Action	1	
75	CLOCK	Object	1	Agree/Agree
76	CLOSE	Property	0	
77	CLOTHES	Object	1	
78	CLOWN	*n.c.*	0	**Disagree (margin: 1.06)**
79	COLD	Property	1	
80	COLOUR	*n.c.*	0	Agree
81	COME	Action	1	Agree
82	CONNECTED	Property	0	
83	COOK	Action	1	Agree
84	COOL	Property	0	
85	COTTON	*n.c.*	0	
86	COURGETTE (fs)	Object	0	
87	COVER	Action	1	
88	COW	Object	1	
89	CREAM	*n.c.*	0	
90	CRY	Action	1	Agree/Agree
91	CUCUMBER	Object	1	
92	CUPBOARD	Object	1	
93	CUT (on body)	Action	1	
94	CUT (slice)	Action	1	
95	CUT (with scissors)	Action	1	
96	DANGEROUS	Property	0	
97	DARK	Property	0	
98	DEAF	*n.c.*	1	**Disagree (margin: 0.06)**
99	DETACH	Action	1	
100	DEPENDS	*n.c.*	0	
101	DIAGNOSE	*n.c.*	0	
102	DIFFERENT	*n.c.*	0	Agree
103	DIFFICULT	*n.c.*	0	Agree
104	DIGITAL	*n.c.*	0	Agree
105	DINNER	*n.c.*	1	
106	DIRTY	Property	0	
107	DASH (leave)	Action	1	

108	DISCUSS	Action	0	
109	DISSOLVE	Action	1	
110	DIVIDE	Action	0	
111	DOCTOR	*n.c.*	0	
112	DOOR	Object	1	
113	DRAW-OUT-BLOOD	Action	1	
114	DRAWER	Object	1	
115	DRILL	Object	1	Agree
116	DRILL (use drill)	Action	1	
117	DRINK	Action	1	Agree
118	DRIVE	Action	1	
119	DROP	Action	1	Agree
120	DUCK	Object	1	Agree
121	EACH	*n.c.*	0	
122	EAR	*n.c.*	1	Agree
123	EARLIER (before)	*n.c.*	0	
124	EASY	*n.c.*	0	Agree/Agree
125	EAT	Action	1	Agree
126	ECO	*n.c.*	0	
127	EGG (break)	Object	1	
128	EGG (cut)	Object	0	Agree
129	EGG (fs)	Object	0	
130	EITHER	*n.c.*	0	
131	ELBOW	*n.c.*	1	
132	ENJOY	*n.c.*	0	
133	ENOUGH	*n.c.*	0	
134	ENTER	Action	1	
135	EQUIPMENT	Object	0	
136	EVERYTHING	*n.c.*	0	
137	EVERYWHERE	*n.c.*	0	
138	EXCITING	*n.c.*	0	Agree
139	EXPLAIN	Action	0	
140	EYE	*n.c.*	1	Agree
141	FAKE	*n.c.*	0	
142	FALL	Action	1	
143	FAMILY	*n.c.*	0	
144	FAR	Property	0	
145	FARM	*n.c.*	0	
146	FAST	Property	0	Agree
147	FAT	Property	1	
148	FAVOURITE	*n.c.*	0	
149	FEEL	Action	0	
150	FEVER	Property	1	
151	FIND	Action	0	Agree
152	FINGER	*n.c.*	1	Agree
153	FINISH	*n.c.*	0	Agree
154	FIRE	*n.c.*	1	Agree
155	FISH (meal)	Object	0	
156	FIX (repair)	Action	0	
157	FIXED (firm)	Property	0	
158	FLASH	*n.c.*	1	Agree
159	FLASHING (lights)	Action	1	
160	FLAVOUR	*n.c.*	0	
161	FLIP-OVER	Action	1	
162	FLOOR	Object	1	
163	FOOD	Object	1	
164	FORK	Object	1	
165	FRIGHTENED	Property	0	Agree
166	FROM-NOW-ON	*n.c.*	0	
167	FRY	Action	1	
168	FRYING PAN	Object	1	
169	FULL	Property	1	
170	FUNNY	Property	0	

171	FUR	*n.c.*	1	
172	GAME	*n.c.*	0	
173	GARAGE	*n.c.*	0	
174	GARDEN	*n.c.*	0	
175	GARLIC	Object	0	
176	GIRL	*n.c.*	0	Agree
177	GIVE	Action	1	
178	GLASSES	Object	0	
179	GO	Action	0	Agree
180	GOOD	*n.c.*	0	
181	GRASS	Object	1	
182	GRAZING	Action	1	
183	GREAT	*n.c.*	0	
184	GREEN/FIELD	Property	0	
185	GROUP	*n.c.*	0	
186	GROW	Action	1	
187	HAIR	*n.c.*	1	Agree
188	HAIRDRESSER	*n.c.*	1	
189	HALF	*n.c.*	1	
190	HAMMER	Object	1	Agree
191	HAMMER (use hammer)	Action	1	
192	HANDS	*n.c.*	1	
193	HANG	Action	1	
194	HAPPEN	*n.c.*	0	
195	HAPPY	Property	0	
196	HARD	Property	0	
197	HAT	Object	1	Agree
198	HATE	*n.c.*	0	Agree
199	HEAD	*n.c.*	1	
200	HEADACHE	Property	0	Agree
201	HEALTH	Property	0	
202	HEAR	Action	1	
203	HEARING	*n.c.*	1	**Disagree (margin: 1.61)**
204	HEARING-AID	Object	1	Agree/Agree
205	HEART	*n.c.*	1	
206	HEARTBEAT	Action	1	
207	HEAVY	Property	1	Agree
208	HELP	Action	0	Agree
209	HEN	Object	1	
210	HERB	Object	0	
211	HIDE	Action	0	
212	HIGH	Property	1	
213	HOLE	Object	1	
214	HOME	*n.c.*	0	
215	HORN	Object	1	
216	HORSE	Object	1	
217	HOSPITAL	*n.c.*	0	Agree
218	HOT	Property	0	Agree
219	HOUSE	Object	1	Agree
220	HUNGRY	Property	0	
221	ILL	Property	0	
222	IMPORTANT	*n.c.*	0	Agree
223	IN	*n.c.*	1	
224	INFECTION	*n.c.*	1	
225	INFORM	Action	0	
226	INJECT	Action	1	Agree
227	INSIDE	*n.c.*	1	
228	INTERESTED	*n.c.*	0	
229	ITSELF	*n.c.*	0	
230	IV	*n.c.*	1	
231	JEWELLERY	Object	0	
232	KICK	Action	1	Agree

233	KNEE	*n.c.*	1	
234	KNIFE	Object	1	Agree
235	LAST	*n.c.*	0	
236	LATER	*n.c.*	0	
237	LAUGH	*n.c.*	0	**Agree/Disagree (margin: 1.55)**
238	LEAVE-BE	*n.c.*	0	
239	LEFT	*n.c.*	0	
240	LEG	*n.c.*	1	
241	LIGHT (lamp)	Object	1	
242	LIKE	*n.c.*	0	
243	LINKED	Property	0	
244	LISTEN	Action	1	
245	LITTLE	Property	1	
246	LIVE	*n.c.*	0	
247	LONG	Property	1	
248	LONG-TIME	*n.c.*	0	Agree
249	LOOK	Action	1	Agree/Agree
250	LOOK-AROUND	Action	1	
251	LOOK-AFTER	Action	0	
252	LOST	*n.c.*	0	
253	LOTS	*n.c.*	0	
254	LOVE (adore)	*n.c.*	0	
255	LOVELY	Property	0	
256	LOW	Property	0	
257	LUNGS	*n.c.*	1	
258	MAKE	Action	0	
259	MAN	Object (refers to farmer toy)	0	Agree
260	MANE	Object	1	
261	MATCH (equal)	*n.c.*	0	
262	MAYBE	*n.c.*	0	
263	MEAN	*n.c.*	0	Agree
264	MEASURE	Action	0	
265	MESSY	Property	0	
266	METAL	Property	0	
267	MIDDLE	*n.c.*	0	
268	MIND	*n.c.*	0	
269	MINUTES	*n.c.*	0	
270	MISSING	*n.c.*	0	
271	MIX	Action	1	
272	MODERN	*n.c.*	0	
273	MORE	*n.c.*	0	Agree
274	MOUTH	*n.c.*	1	Agree
275	MOVE	Action	1	
276	NAIL	Object	1	
277	NAME	*n.c.*	0	Agree/Agree
278	NEED	*n.c.*	0	
279	NEVER	*n.c.*	0	Agree
280	NEVERMIND	*n.c.*	0	
281	NEW	Property	0	Agree
282	NEXT	*n.c.*	0	
283	NICE	Property	0	Agree
284	NOISE	Property	0	
285	NONE	*n.c.*	0	
286	NORMAL	*n.c.*	1	
287	NOSE	*n.c.*	1	Agree
288	NOTHING	*n.c.*	0	
289	NUMBER	*n.c.*	0	Agree
290	NURSE	*n.c.*	0	
291	OFF	*n.c.*	1	
292	OFFER	Action	1	
293	OLD	Property	0	

294	ON	*n.c.*	1	
295	ONE-MORE	*n.c.*	0	
296	ONE-WEEK	*n.c.*	0	
297	ONLY	*n.c.*	0	
298	OPEN (door)	Action	1	
299	OPEN (container)	Action	1	
300	OPERATE	Action	1	
301	ORANGE	Property	0	Agree
302	OTHER	*n.c.*	0	
303	OTOSCOPE	Object	1	
304	OUTSIDE	*n.c.*	1	
305	PAIN/HURT	Property	0	
306	PAN	Object	0	
307	PARENTS	*n.c.*	0	Agree
308	PARSNIP	Object	0	
309	PASS	Action	0	
310	PATCH	*n.c.*	1	
311	PEEL	Action	1	
312	PEOPLE	*n.c.*	0	Agree/Agree
313	PEPPER	Object	1	
314	PERFECT	*n.c.*	0	
315	PICK	Action	0	
316	PICTURE	Object	0	
317	PIECE	Object	0	
318	PIG	Object	1	Agree
319	PILL	Object	1	
320	PINK	Property	0	Agree/Agree
321	PIZZA	Object	1	
322	PLASTER	Object	1	
323	PLASTIC	Property	0	
324	PLATE	Object	1	
325	PLATFORM	Object	1	
326	PLAY	Action	0	
327	POLAND	*n.c.*	0	
328	POOR	Property	0	Agree/Agree
329	POT	Object	1	
330	POUR	Action	1	
331	PRACTICE	*n.c.*	0	
332	PREGNANT	*n.c.*	1	
333	PREPARE	Action	0	
334	PRESS (garlic)	Action	1	
335	PRESS (button)	Action	1	
336	PRETEND	*n.c.*	0	Agree
337	PROGRAM	*n.c.*	0	
338	PROGRESS	*n.c.*	0	
339	PROTECT	Action	0	Agree/Agree
340	PROUD	Property	0	
341	PULL	Action	1	Agree
342	PULL-SWITCH	Action	1	
343	PURPLE	Property	0	
344	PUT	Action	1	
345	PLACE (location)	*n.c.*	1	
346	QUICK	Property	0	Agree
347	RABBIT	Object	1	Agree/Agree
348	READY	*n.c.*	0	
349	REAL	*n.c.*	0	
350	RECENT	*n.c.*	0	Agree
351	RECYCLE	*n.c.*	0	
352	RED	Property	0	Agree/Agree
353	REFLEX	*n.c.*	0	
354	REGULAR	*n.c.*	0	
355	RELIEVED	Property	0	
356	REMOVE	Action	1	

357	RESPONSIBLE	*n.c.*	0	Agree
358	ROOF	Object	1	
359	ROUND	Property	1	
360	RUN	Action	1	
361	SAD	Property	0	Agree
362	SAFE/SAVE	*n.c.*	0	
363	SALT	Object	1	
364	SAME/ALSO	*n.c.*	0	Agree
365	SAUCEPAN	Object	1	
366	SAUSAGE	Object	1	
367	SAW (handsaw)	Object	1	Agree/Agree
368	SAW (use saw)	Action	1	
369	SAW (circular saw)	Object	1	
370	SCAR	Object	1	Agree
371	SCISSORS	Object	1	
372	SCORE	*n.c.*	0	
373	SCRAPE	Action	1	
374	SCRATCH	Action	1	Agree
375	SCREW (use screwdriver)	Action	1	
376	SCREWDRIVER	Object	1	
377	SEARCH	Action	0	Agree
378	SEE	Action	1	Agree
379	SEE-THROUGH	*n.c.*	1	
380	SEND	Action	1	
381	SEPARATE	Action	1	
382	SHAME	*n.c.*	0	Agree
383	SHARE	Action	0	
384	SHARP	Property	0	
385	SHEEP	Object	1	
386	SHELF	Object	1	
387	SHORT	Property	1	
388	SHOT	*n.c.*	1	
389	SHOUT/CALL	Action	1	Agree
390	SIGN	Action	0	
391	SIMILAR	*n.c.*	0	Agree
392	SISTER	*n.c.*	0	Agree/Agree
393	SIT	Action	1	
394	SKILL	*n.c.*	0	
395	SLEEP (hand on cheek)	Action	1	
396	SLOW	Property	0	Agree
397	SMALL	Property	1	
398	SMELL	Action	1	Agree
399	SMELLY	Property	1	
400	SOFT (gentle)	Property	0	
401	SOFT	Property	1	
402	SOME	*n.c.*	0	
403	SOMETHING	*n.c.*	0	Agree
404	SOMETIMES	*n.c.*	0	
405	SOON	*n.c.*	0	
406	SOUP	Object	1	
407	SPANNER	Object	1	
408	SPATULA	Object	1	
409	SPECIAL	*n.c.*	0	
410	SPEAK	Action	1	Agree
411	SPIN	Action	1	
412	SPOON	Object	1	
413	SQUASH (food)	Object	0	
414	STAND	Action	1	
415	START	*n.c.*	0	Agree
416	STAY	*n.c.*	1	
417	STETHOSCOPE	Object	1	

418	STIR	Action	1	Agree
419	STOMACH	*n.c.*	1	
420	STOMACHACHE	Property	0	
421	STOP	*n.c.*	0	Agree
422	STORY	*n.c.*	0	
423	STRANGE	*n.c.*	0	
424	STRONG	Property	1	
425	STUCK	Property	0	
426	STYLE	*n.c.*	0	
427	SUITABLE	*n.c.*	0	
428	SUPER	*n.c.*	0	
429	SURE	*n.c.*	0	
430	SURPRISE	Property	0	
431	SWAB	Action	1	
432	SWOLLEN	Property	1	
433	SYRINGE	Object	1	
434	TABLE	Object	1	
435	TAIL	*n.c.*	1	
436	TAKE (grab)	Action	1	
437	TAKE-PILLS	Action	1	
438	TALL	Property	1	
439	TAP	Action	1	
440	TASTE	*n.c.*	1	Agree
441	TEACH	Action	0	
442	TELEVISION (frame)	Object	1	Agree
443	TELL/SAY	*n.c.*	0	**Agree/Disagree (margin: 0.18)**
444	TEMPERATURE	*n.c.*	1	
445	TEST	*n.c.*	0	
446	THAN	*n.c.*	0	
447	THANK YOU	*n.c.*	0	Agree
448	THERE	*n.c.*	0	
449	THERMOMETER	Object	1	
450	THING	*n.c.*	0	Agree
451	THIRSTY	Property	1	Agree
452	THROAT	*n.c.*	1	Agree
453	THROUGH	*n.c.*	1	
454	TIME	*n.c.*	1	Agree/Agree
455	TIP-OVER	Action	1	
456	TIRED	Property	0	
457	TODAY	*n.c.*	0	
458	TOMATO	Object	0	Agree/Agree
459	TONGUE	*n.c.*	1	Agree
460	TONIGHT	*n.c.*	0	
461	TOOL	Object	1	
462	TOOLBOX	Object	1	
463	TOUCH	Action	1	Agree
464	TOY	Object	0	
465	TRACTOR	Object	1	
466	TRAILER	Object	1	
467	TRAIN	Object	1	
468	TREATMENT	*n.c.*	0	
469	TREE	Object	1	Agree
470	TRUE	*n.c.*	0	Agree
471	TRY	Action	0	Agree
472	TURN (next)	*n.c.*	0	
473	TURN ON/OFF	Action	1	
474	TV	Object	0	
475	TWEEZERS	Object	1	
476	UNDER	*n.c.*	1	
477	USE	Action	0	
478	USE-SPANNER	Action	1	

479	VEE (GREAT)	*n.c.*	0	**Disagree (margin: 0.30)**
480	VEGETABLES	Object	0	
481	PRAISE	Action	0	
482	VIBRATE	Action	0	
483	VIEW	Action	1	Agree
484	VISIT	Action	0	
485	WAIT	Action	0	Agree
486	WALK	Action	1	Agree
487	WALL	Object	1	
488	WANT	*n.c.*	0	
489	WATER	*n.c.*	0	Agree
490	WAVE (hand)	Action	1	
491	WAX	*n.c.*	0	
492	WHEEL	Object	1	
493	WHEELS-MOVE	Action	1	
494	WHITE	Property	0	Agree
495	WHOLE	*n.c.*	0	
496	WINDOW	Object	1	Agree
497	WONDER	*n.c.*	0	
498	WOOD	Property	0	
499	WORK	Action	0	Agree
500	WORRY	*n.c.*	0	Agree/Agree
501	WOW	*n.c.*	0	Agree
502	WRONG	*n.c.*	0	Agree
503	YELLOW	Property	0	Agree/Agree
504	YOLK	Object	0	
505	YOUNG	Property	0	Agree
506	YUMMY	Property	1	